23 March 1992 Final Student Research Report

Copernicus and MTACCS: Expanding the Info-Zone

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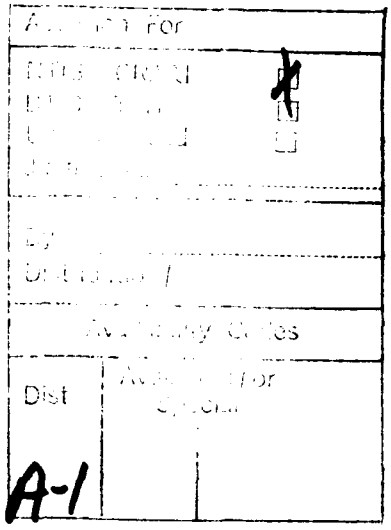
Thesis: The United States Navy and the Marine Corps will benefit from interoperability between the two command and control systems but coordination must begin now to ensure that interoperability occurs. This paper discusses interoperability issues associated with command and control systems development.

USMC; Command and Control; C2; C3; C4I; Joint Command and Control; COPERNICUS; GLOBIXS; CCC; TADIXS; TCC; TCO; FIREFLEX; MTACCS; MACCS; MAGIS; MIPS 31

Unclassified Unclassified Unclassified

COPERNICUS AND MTACCS: EXPANDING THE INFO-ZONE



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EXPANDING THE INFO-ZONE:

COPERNICUS AND MTACCS

Thesis statement: The Navy and the Marine Corps will benefit from interoperability between the two command and control systems but coordination must begin now to ensure that interoperability occurs.

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COPERNICUS AND MTACCS: EXPANDING THE INFO-ZONE

In today's rapidly changing world, our national military forces find themselves on new and shifting ground. The triumph of peace in certain regions of the world contributes to shifts of power. Tremors of instability rattle dormant conflicts. The services must modernize in preparation for the new "world order" and the 21st century. One weak area in recent military operations is command and control. The Navy is currently developing a concept called Copernicus for future implementation as the state-of-the-art command and control system. Meanwhile, the USMC is streamlining its MTACCS family of hardware to replace its aging current equipment system.

It is likely that in the future, American response to crisis will be at least joint in nature and, most likely, combined with forces from other countries. Especially now, to get the most bang for our buck, we should ensure that any system we are spending time and money to develop should be interoperable with our sister service. Though both systems were initially being developed "in a vacuum," it has become apparent that the Marine Corps will want to be involved in the Navy's program and vice versa. The Marine Corps will benefit from MTACCS. The Navy will benefit from Copernicus. The Navy-Marine Corps team will benefit from interoperability between the two.

The Navy's Antiquated Command and Control

Naval command and control is the warfare function through which a maritime commander delegates or directs warfighting responsibilities to his subordinates. Command and control is exercised through a supporting technological, doctrinal, and organizational system known today as Command, Control, Communications, Computers, and Intelligence (C^4I.) The Navy's current C^4I system is characterized by inflexibility. Today's commander relies primarily on his own airborne and shipboard sensors for information. Unfortunately, his antiquated (1950's and 1960's technology, insome cases,) equipment limits him from obtaining needed information about the present larger-scale battlefield.

In addition, serious weaknesses in information management and intelligence dissemination are setting unnecessary and artificial limitations on the commander's ability to command and control his forces. Today's information systems cannot separate operational traffic from administrative traffic. Literally, 33,000 commands ashore address messages to their tactical commander "...at <u>their</u> collective whim," not his. (1:2-8) In effect, the commander (or his representative) is forced to read all the incoming message traffic in order to glean the information he needs. The current system, with its proliferation of messages, is a "push it all at you" architecture instead of a "pull-it-

from the shelf" information flow. (1:2-10)

This has led to the Navy's short-term solution; "minimize" messages. The result is that only messages flagged as "immediate," "priority," or "flash" can pass through the message transfer system. The vast majority of messages, flagged as "routine," are automatically held aside in the system until their transmission will not hinder the delivering any higher priority traffic. Due to the volume of message traffic involved, a huge backlog occurs with "routine" messages being held up for days and sometimes being sent in bulk by mail instead. "Copernicus could eliminate the need for minimization activity," said Master Chief Burkard, radio chief of the nuclear-powered aircraft carrier, USS J.F. Kennedy. Theoretically, using Copernicus' process of compressing narrative traffic into a digital version, Navy operators could transmit eight times more information than they can at present. (7:12)

Copernicus has been designed to restructure the Navy's C^4I system by providing the "...doctrinal, technological, and organizational infrastructure needed to weave [together] the modern tactical fabric of war at sea..."(1:1-10)

Copernicus Architecture

The goal behind the Copernicus architecture is to provide information faster and more efficiently by

connecting the fleet to onshore databases. The means for these connections is increased use of military and commercial satellites, thus providing greater bandwith. In other words, Copernicus seeks to provide high-volume digital data-link in near real-time.

Copernicus is based on four pillars: the Global Information Exchange System (GLOBIXS,) the CINC Command Complex (CCC,) the Tactical Data Information Exchange Systems (TADIXS,) and the Tactical Command Center (TCC.) These four pillars will construct an interactive framework that ties together the command and control process of the Navy tactical commander afloat, his fleet commander, and others to the CINC's ashore. (8:1)

The first pillar: GLOBIXS

Global Information Exchange Systems (GLOBIXS) are the virtual networks that link the commands and activities ashore in order to support the forces afloat. In this case, "virtual" means the powerful and flexible communications highways that link the system together. They are configured on a theater or worldwide basis and are constructed to transport, standardize, and concentrate shore-based sensor, analytic, command support, administrative, and other data for further passage to commanders afloat. GLOBIXS will employ current and planned common-user communications

systems such as the evolving Defense Communications System (DCS.) It will provide information management and information concentration by acting as the shore gateway for specific reports to sea and abroad. These GLOBIXS will be engineered like interstate highways; they offer limited access, high speed, and high concentration. They will be interconnected so that traffic may be shunted across several GLOBIXS as well as to the operating forces through a consolidated CINC Command Complex (CCC,) the second pillar of Copernicus. (1:4-3) (See Figure 1)

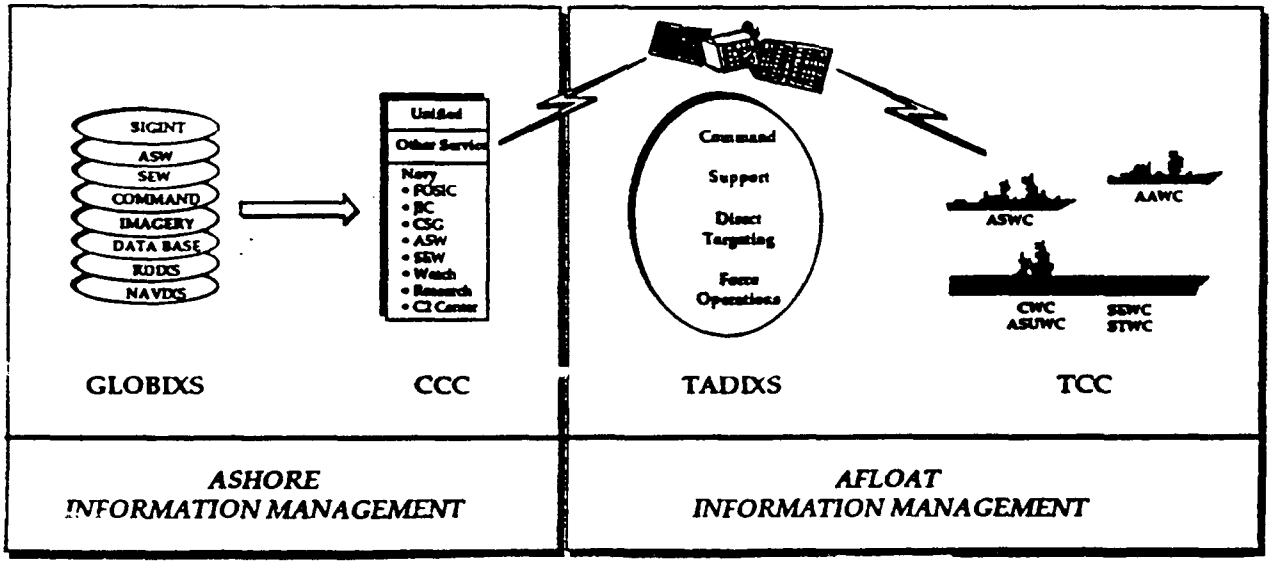

Figure 1. (1:8-1)

The second pillar: CCC

The CCC, as envisioned by Copernicus designers, would include a number of existing organizations brought together technologically by common workstations connected to a metropolitan area network (MAN) using common bearer services available in that area. (1:5-2) The Copernican CCC will centralize C^4I for the CINC. By processing, displaying, and disseminating organic and non-organic information (including national and theater sensor and imagery information,) it gives the commander a clear picture of operations within the theater. This information is the basis for plans of action and force-direction decisions.

Within all CCC centers, a local area network connects computer-based systems and system components. The local area networks provide gateways to larger (metropolitan area) networks. MANs connect distant centers together and, in turn, provide gateways to afloat Tactical Data Information Exchange Systems (TADIXS.) This connection occurs via the Communication Support System (CSS) and the ashore GLOBIXS networks. Through the CCC, the Copernicus objective is to provide the CINC's and subordinate commanders with a flexible, selectable set of capabilities that support tactical and strategic command functions and responsibilities. Additionally, Copernicus' CCC facilitates the development of products that support command functions like intelligence, weather, surveillance. (See Figure 1)

The third pillar: TADIXS

Architects of Copernicus call the CINC Command Complex (CCC) and the Tactical Command Center (TCC), "the centers of the universe" for the Navy. The CCC and TCC will share a common tactical picture through a series of Tactical Data Information Exchange Systems (TADIXS,) the third pillar of Copernicus. (1:6-2) Like GLOBIXS and the CCC, the TADIXS are not rigid; they are established at the request of, and in the mix desired by, the tactical commander. TADIXS will greatly improve information management. Because the TADIXS are "virtual" nets and have common engineering basis, Copernicus TADIXS can be compared to telephone calls over a commercial network; the call can be made to anyone, for any purpose, over any available communications pathway, for the length of time necessary to convey the information.

TADIXS management incorporates two functions: determining the destination of specific data on the CCC and TCC networks and determining what communications channel will be used to transfer the data. The first function is a deliberate one: data may go to one destination, be shared by more than one destination, or not be sent at all, at the discretion of the tactical commander's designated subordinate afloat and the CCC personnel ashore. This decision concerns distribution, and it is made within each operational strata.

The engineering consideration as to efficiency of data "bundling" is an integral part of TADIXS communications channeling, the second function of TADIXS management. Unlike the information management function, this one is not distributed. The communication support service transmits "bundled" data between afloat platforms and to/from the CCC ashore. Whether transmission is accomplished by HF, VHF, UHF, or SATCOM, it is managed by the TCC. From the operator's perspective, the TADIXS will seem to be a constant connection for the duration of the "telephone call" or session. The CSS will automatically manage the communications pathways until, in a tactical situation, the available capacity is insufficient to meet operational requirements. In that instance, the decision (as to which information is mission critical) will be made by the commander, not the communicator. TADIXS carries the information between the CCC and the TCC. (See Figure 1)

The fourth pillar: TCC

The final pillar of Copernicus architecture is the Tactical Command Center (TCC.) The TCC is intended to be the combat "nerve centers" of the tactical commander and his units. The TCC is analogous to the command post of the individual unit or of the multi-force commander. (1:7-2) The TCC provides tactical displays, integrated information

management, and accessibility to tactical communications in support of the warfighting mission. The TCC provides the requisite battle connectivity to units, other force commanders, and the Commander-in-Chief Command Complex (CCC.) Architecturally, the TCC is analogous to the ashore command center, the CCC. Both will share a consistent tactical picture and connect the Navy to the services and to allies at the tactical level and the theater level. (See Figure 1)

Each pillar of the Copernicus architecture has some unique characteristics, but several common elements lend cohesion. The first common element is the "virtual" nature of the four pillars. GLOBIXS and TADIXS are virtual communications services that use physical bearer services for transmission. ("Bearer services" refers to any transmission means whether it be wire, cable, radio frequency energy, etc.) CCC and TCC employ virtual command and control services, permitting personnel in different command center spaces to interact as if all were physically located in the same command post. The second element is the use of functions to define the services. This structured approach to service definition permits common-user needs to be identified. The third commonality is the application of building blocks to these functions. Building blocks identify, in engineering terms, how the architecture is to be achieved. These "building blocks" allow the system to

start implementing some of the Navy's current equipment and then add new software and, eventually, new and more efficient hardware. The common operating environment is the final element among the pillars; it provides the technical standards that cement the architectures building blocks together. (See Figure 2)

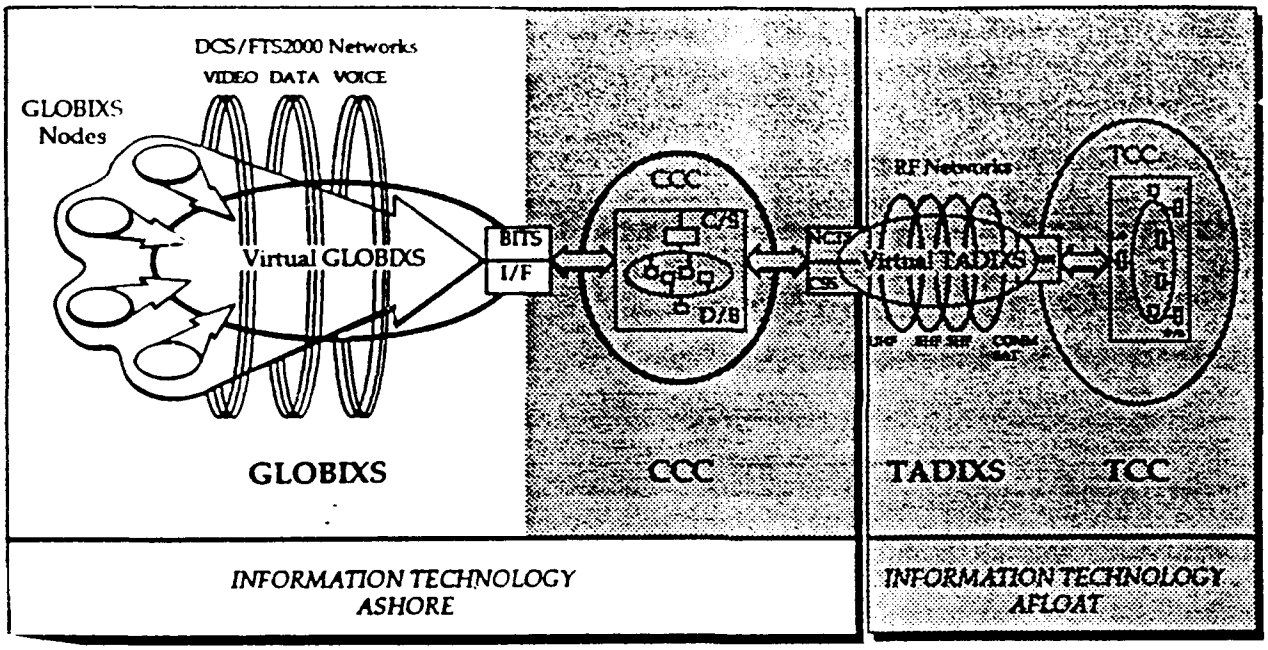

Figure 2. (1:8-7)

While the Navy is energetically pushing for development of Copernicus, the Marine Corps is pursuing an improved command and control system of its own.

The Marine Corps' Weaknesses in Command and Control

The Marine Corps' weaknesses have been similar to the Navy's, in that today's demands have exceeded the capabilities of outdated equipment. Battlefield size is increasing, causing more people to require access to communications paths over greater distances. Frequencies and satellite paths have become congested with more lower level users than ever before. Newer, more technologically advanced equipment offers better reliability, survivability, speed, and efficiency. Recent conflicts have underscored the need for the Marine Corps, especially considering its expeditionary and special operations capabilities, to obtain the most flexible, robust, and interactive system available.

Marine Tactical Command and Control System (MTACCS)

A Marine Air Ground Task Force (MAGTF) commander depends upon information from a wide range of sources to provide the basis for his decisions. In the past, he and his staff would query relevant sources that would search out and provide answers to those questions. The answers (or data) might or might not arrive in a form usable by the commander's staff. Most source information consists of blocks of related or repetitive data. The advent of

computerization has, on the positive side, provided efficiency in keeping information current and being able to respond more quickly to the commander's request. Simultaneously, the increasing use of computers (to collect, process, store, and pass on information) in virtually every area of military endeavor, has created an environment in which the battlefield commander can be inundated with data.

Modern weaponry creates a battlefield characterized by fast and fluid engagements. The pace and quantity of information bound for the commander can only be accommodated by computer-aided automation. Today's tactical commander requires nearly the same capability of receiving, processing, storing, and displaying information as is available to the varied military functional areas acting as sources. This automation of battlefield functions will provide a means of passing digitally formatted information (which is secure and reliable) much faster than traditional analog voice transmission. As a result, voice nets will be freed up for critical commander-to-commander voice communications.

General Gray, while Commandant of the Marine Corps, said that MTACCS is an integrated, automated command and control system with supporting tactical communications that covers all battlefield functional areas. (2:74)

MTACCS will enhance the commander's decision-making ability and provide the tools necessary for effective and

efficient command and control. MTACCS supports maneuver warfare and MAGTF internal functions by focusing on the operational level of war, the MAGTF area of influence.

The objective of the MTACCS concept is to provide MAGTF commanders with an integrated set of sub-systems which can receive, process, display, store, and distribute essential information. MTACCS is an engineering effort designed to manage the integration of current and developing automated systems to support tactical operations. MTACCS will provide commanders with a semi-automated, secure, versatile, rugged, and integrated system of tools to assist them in effective command and control. MTACCS will consist of functionally-oriented systems using common design philosophy and operational procedures and compatible equipment and databases. System designers state that, where appropriate, MTACCS will interoperate with other systems internal and external to the Marine Corps. (4:15)

MTACCS is based upon the integrated use of digital and analog communications to support the Marine commander's tactical and non-tactical missions with fused and correlated information.

Specifically, MTACCS will assist the commander in the following areas:

- Planning, coordinating, and supervising the tactical employment of aviation, ground, and combat service support elements

- o Controlling and evaluating the combat situation
- o Receiving, maintaining, and displaying selective real-time or near real-time combat information
- o Determining the priority of tasking for personnel and the allocation of material
- o Receiving, collating, and analyzing reports, requests, and information between different units (6:10)

MARINE TACTICAL COMMAND AND CONTROL SYSTEM

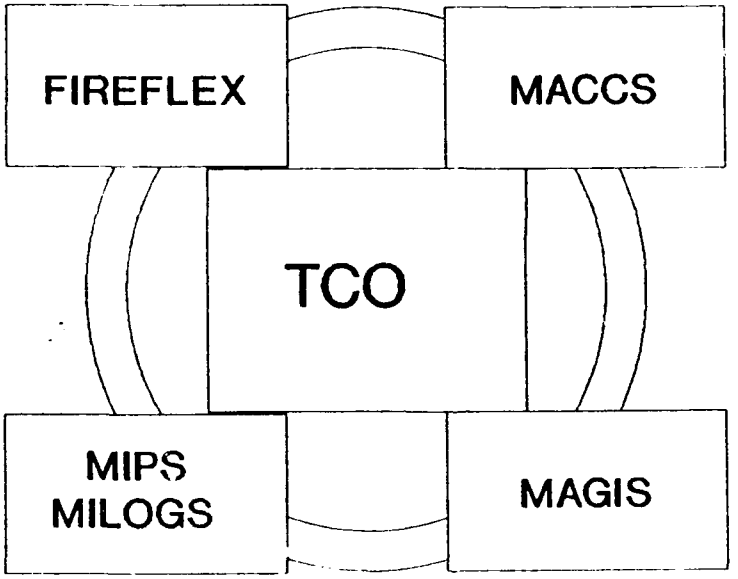

Figure 3. (5:1-3)

The following are major sub-systems of MTACCS:(See Figure 3)

- o TCO (Tactical Combat Operations)
- o FIREFLEX (Marine Flexible Fire Support)
- o MACCS (Marine Air Command and Control System)
- o MIPS/MILOGS (Marine Integrated Personnel System/ Marine Integrated Logistics System)
- o MAGIS (Marine Air Ground Intelligence System)

TCO (Tactical Combat Operations)

The purpose of TCO is to expedite the existing manual process by which decisions are made and executed, to increase the capability to conduct planning, manage combat assets, and exercise tactical control. The TCO is the hub at every command level. (See Figure 4)

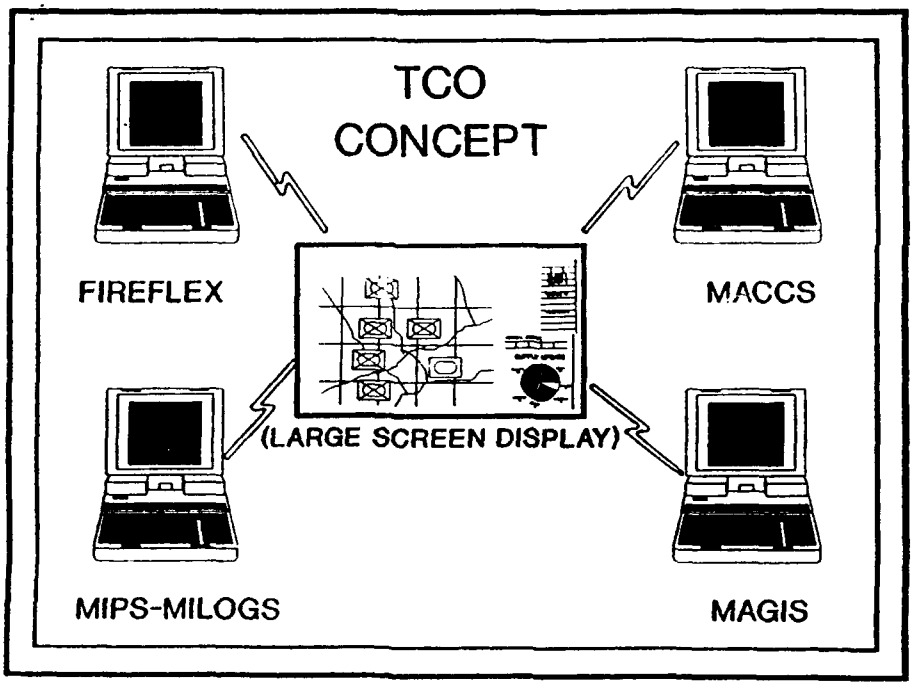

Figure 4. (5:2-3)

The TCO provides commanders at all MAGTF and subordinate elements/unit levels the automation necessary to collate, store, analyze, prepare, and disseminate operational information. TCO's at the different unit locations will utilize workstations (computers) with software-tailored applications and database to support the command operations.

FIREFLEX (Marine Flexible Fire Support)

The purpose of FIREFLEX is to enable the unit to receive, transmit, edit, display, and process fire support requests and to store data to facilitate fire support coordination at each level of command. (See Figure 5)

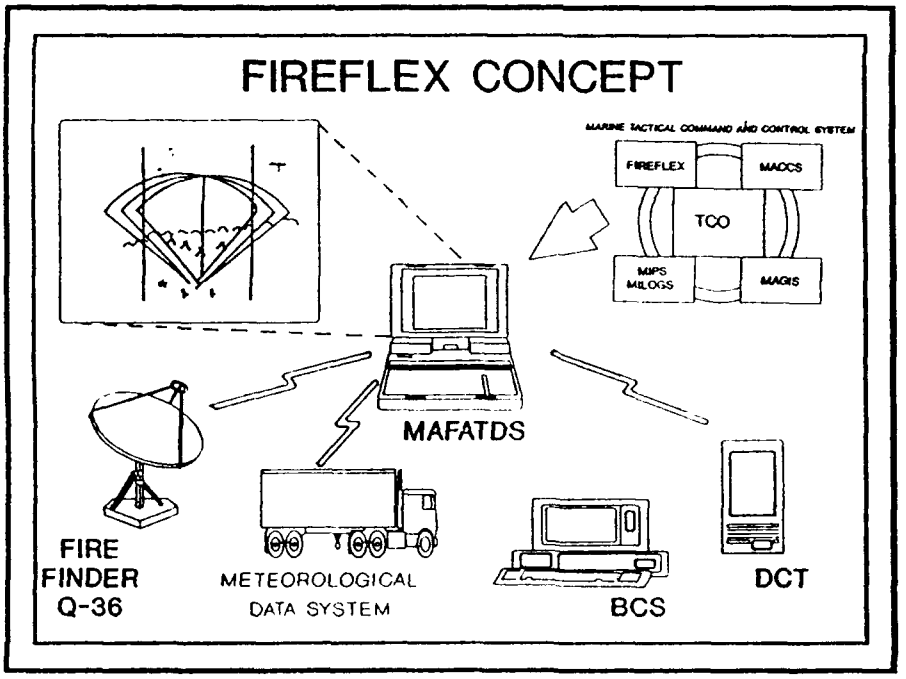

Figure 5. (5:3-4)

MACCS (Marine Air Command and Control System)

The purpose of MACCS is to enable the TAC and MAGTF Commander to maintain complete information on the tactical air situation, manage all aircraft, and properly assign/ utilize the air control and air defense assets. (See Figure 6)

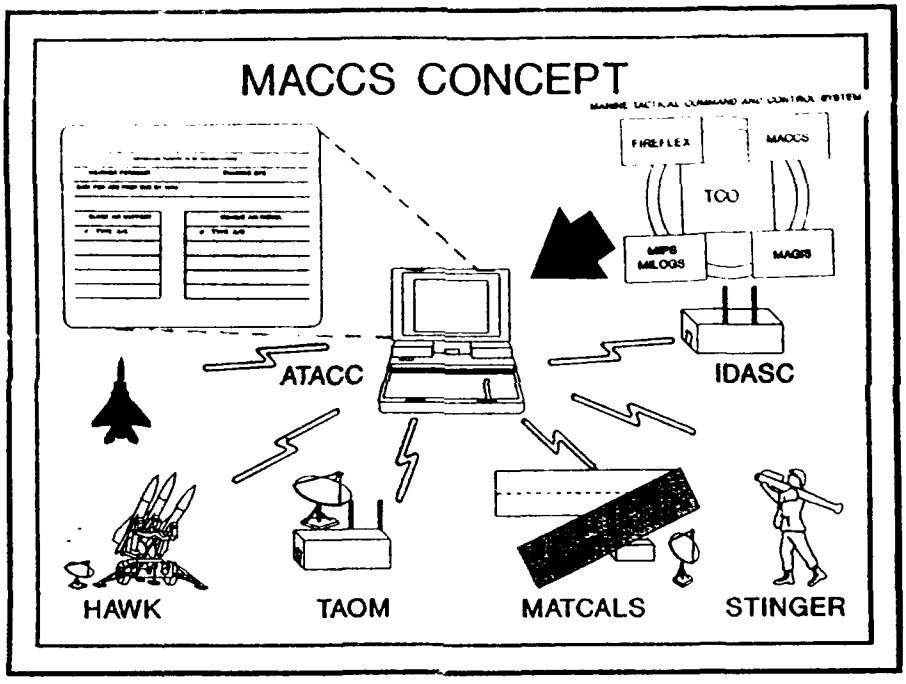

Figure 6. (5:4-3)

The MACCS facilitates automated exchange and processing of tactical information and computer-aided mission planning. For automated dissemination of air tasking orders (ATO's,) plans, and schedules, MACCS is a critical need.

MIPS/MILOGS (Marine Integrated Personnel System/Integrated Logistics System)

The purpose of MIPS is to automate the current manual method of collecting, analyzing, and distributing personnel information in the field. The purpose of MILOGS is similar to MIPS except that it deals with logistical information. (See Figure 7)

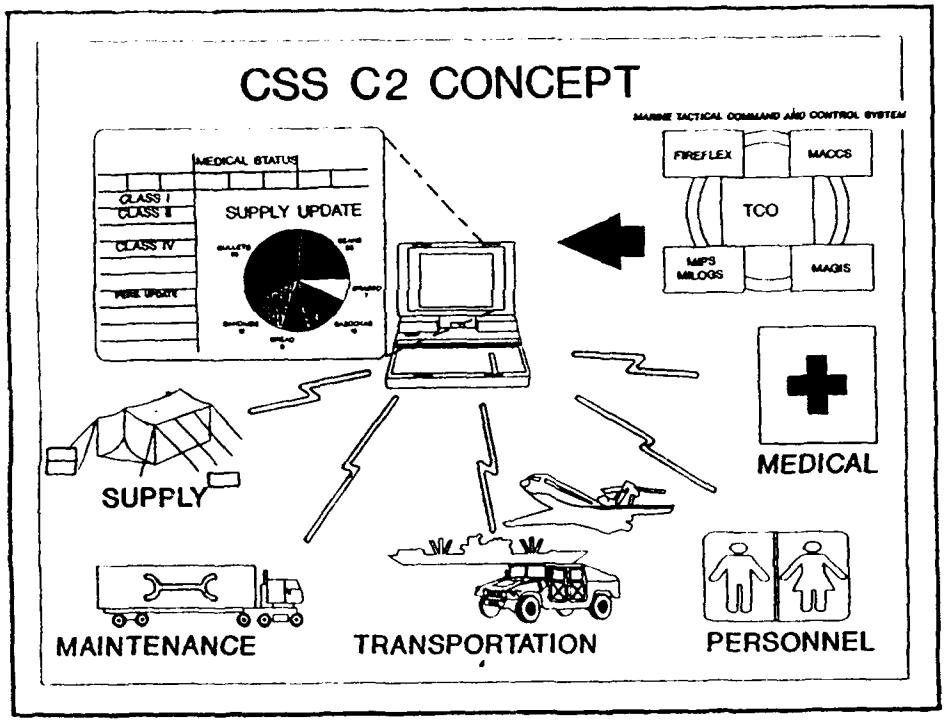

Figure 7. (5:5-1)

MAGIS (Marine Air Ground Intelligence System)

Along the same lines, MAGIS will modernize the current manual system of directing, collecting, processing, and disseminating combat intelligence in the field environment. (See Figure 8)

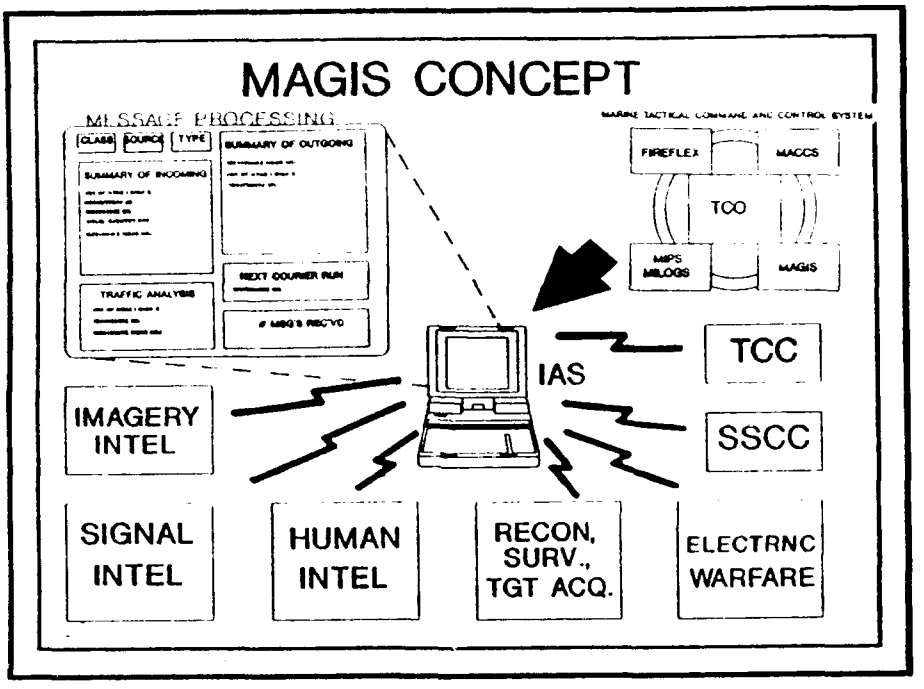

Figure 8. (5:6-3)

The Marine Corps' efforts to modernize battlefield command and control functions have resulted in MTACCS. By definition, MTACCS is the comprehensive automated tactical system that will provide the equipment, communications, and software to support a MAGTF. MTACCS focuses on planning, directing, coordinating, and controlling tactical operations with a single integrating tactical information system.

Copernicus and MTACCS

Automated information transfer allows the commander to make an informed decision faster than the enemy. Although MTACCS and Copernicus are being developed separately, they share a common basic purpose. Both systems use a series of local area networks and data transmissions to distribute information between users.

Unlike Copernicus' global capability, MTACCS presently concentrates on information management at the intratheater level. There are several areas within the Copernicus architecture which could readily be exploited by MTACCS.

1. Get rid of excess message traffic (junk mail.) and distribute information as efficiently as possible.
2. Allow a commander to decide which type of information he needs at a particular point in time. (This "mix" can be changed at any time.)
3. Enable tactical commanders to benefit directly from national assets.

The Navy and the Marine Corps presently have an information distribution problem. Data and messages are currently received by a communications center, either ashore or afloat. The communications center watch-standers process the messages for delivery or distribution to addressees, using plain-language addresses (PLA's) and hard-copy messages. Both Copernicus and MTACCS plan to deliver/

distribute the information via the unit's internal Local Area Network in near real-time fashion. The communications system that will join these LAN's together will be "transparent to the user." Information sent up and down the chain-of-command will not be manually processed or retransmitted at every level. This innovation will greatly reduce the time and paperwork historically required to accomplish the message distribution task. However, MTACCS will employ this technology at the tactical level only; information from out of theater will still be message traffic. Messages must be manually entered onto the MTACCS personal computers. If MTACCS were linked to Copernicus, this time-consuming action would be unnecessary.

The commander of the Amphibious Ready Group (ARG) is able to pick and choose what information he wants to receive. The TCC requests information via the CCC based on his needs. The CCC then ties in with the appropriate information GLOBIXS to support the TCC mission. Since MTACCS does not reach out of theater, the TCO ashore has information "pushed" to him via message traffic by whatever agencies want to send him information. He does not have the option of choosing what information he receives. A MAGTF TCO ashore could select the information most useful to him in a manner similar to the TCC if MTACCS were linked to Copernicus. The result would be to do away with the relatively slow, redundant, non-tailored message traffic and

give access to specific information from outside the theater, quickly and in usable format.

Both MTACCS and Copernicus envision national assets being available to tactical commanders. The commander would not control those assets, he would merely be "info sharing" the output of, for example, an intelligence imagery satellite. MTACCS will utilize the Marine Air Ground Intelligence System (MAGIS) to accomplish this liaison, whereas Copernicus will have this capability built in as part of its architecture. The Navy presently possesses the communications paths, hardware, and software to obtain this type of information via Naval Intelligence Products System (NIPS), Military Information Department of Defense System/ Intelligence Data Base (MIDDS/IDB,) Fleet Imagery Support Terminal (FIST,) etc. The Marine Corps is studying the problem and evaluating which equipment would be most appropriate to solve it. The MAGIS system currently in use does not provide this capability since MAGIS has no data base, hardware, or software that will interface with other agencies, such as JICPAC, AIC, or DIA. Inter-connecting MAGIS ashore with the J.I.C. afloat via Copernicus would provide the tactical Marine commander with access to the fruits of national assets.

In addition to the previously mentioned three goals, if MTACCS could interface with Copernicus, pathways would exist to link Fireflex with the SACC, TACC ashore with TACC

afloat, and MIPS/MILOGS with TACLOG. The goal would be to facilitate data transfer between these agencies on a near real-time basis and to greatly reduce single-channel radio transmission and excess message flow during operations. Pathways between the previously mentioned systems would benefit the Navy as well as the Marine Corps.

Inevitable Hurdles

While linking with Copernicus would greatly improve the capabilities of MTACCS, there are several problems to consider. The Marine Corps must coordinate with the Navy concerning Copernicus' development of software, GLOBIXS, and hardware if the two systems are to interoperate. Copernicus is currently a concept only. MTACCS plans are virtually completed and some equipment is already in use. If the two systems are to be compatible, Copernicus planners will have to consider this fact and make any necessary adaptations to allow for interoperability. In particular, software packages for the Marine Corps will have to be developed in conjunction with Copernicus software.

If the Marine Corps is going to interface with Copernicus, we must coordinate with the Navy on the agencies that make up GLOBIXS. If the Marine commander is going to obtain tailored information from out-of-theater, he should have something to say about what agencies are required to

provide what types of information. This may entail having Marines positioned at the Naval CCC to help coordinate "throughput."

The radios that provide the pathways for the LAN's of MTACCS and Copernicus must be compatible. Also, there must be enough satellites to handle the volume of information. Most important, the Navy must be willing to share some communications pathways with the Marine Corps. If compatible computers (hardware and software) are not used between the two systems, then some type of adapter device (gateway) or cable will be necessary.

Other problems will undoubtedly occur as we attempt to mesh one system to another, but technology can overcome those obstacles. Procrastination will make a solution more difficult to reach. Incompatibilities cannot be identified, much less removed, if the Navy and Marine Corps continue with development of each system ignoring the other...working in a vacuum. The synergistic effects that can be achieved by ensuring the interoperability of these two systems are too great to sacrifice to interservice ambivalence, selfishness, or pride.

Many of the technologies mentioned already exist; some are even being used by other services or private industry. Command System Inc., the contractor for MTACCS, is currently exploring methods and technologies that may be used to integrate the two systems. However, to ensure inter-

operability, the Navy/ Marine Corps team must also tackle the problem. One recommendation is to form a joint committee to work together on interoperability issues. This committee should include experts such as information systems managers, from MTACCS and Copernicus in the functional areas previously mentioned. In addition, periodic meetings to discuss operational goals should include commanders and officers who specialize in communications, intelligence, logistics, fire support and air support, the operators. Such committees of people working together could ensure that MTACCS and Copernicus will interoperate, while also retaining the capabilities in each functional area that provide the commander with the information that he needs. The best technology could then be used to solve problems, redundancy of effort could be reduced, and the two complimentary systems modeled to support the Navy-Marine Corps team in the joint environment.

Recent conflicts have shown that one of our greatest weaknesses is the inability to efficiently manage information. Efforts to solve this problem have sent all services scrambling in search of the perfect system. Developing two incompatible system designs is not the answer, but the idea of making MTACCS and Copernicus interoperable has still been met with significant disagreement. First, the services must recognize that whatever price is paid in dollars, man-hours, or energy will

undergo scrutiny like never before. Wasted or redundant efforts are infinitely more costly considering the ever-shrinking military budget. Existing technology should be exploited to the fullest extent possible.

We must halt the current trend to independently develop command and control systems. The intercontinental scale of the battlefield and participation by multiple forces in times of conflict drive the requirement to focus efforts now on interoperability.

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